S.E. Sem IV (CBGS) - Control Systems — 16/6/14
EXTC.

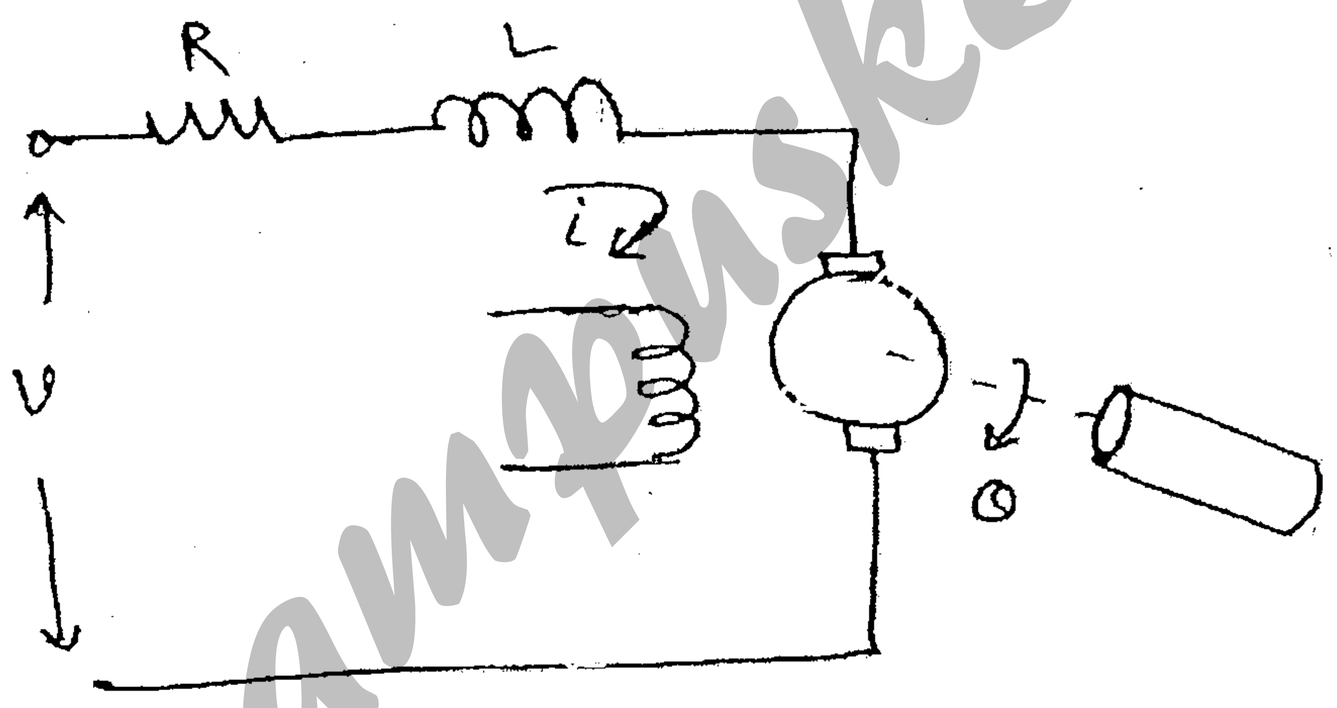
QP Code : **NP-19880**

(3 Hours) [Total Marks : 80

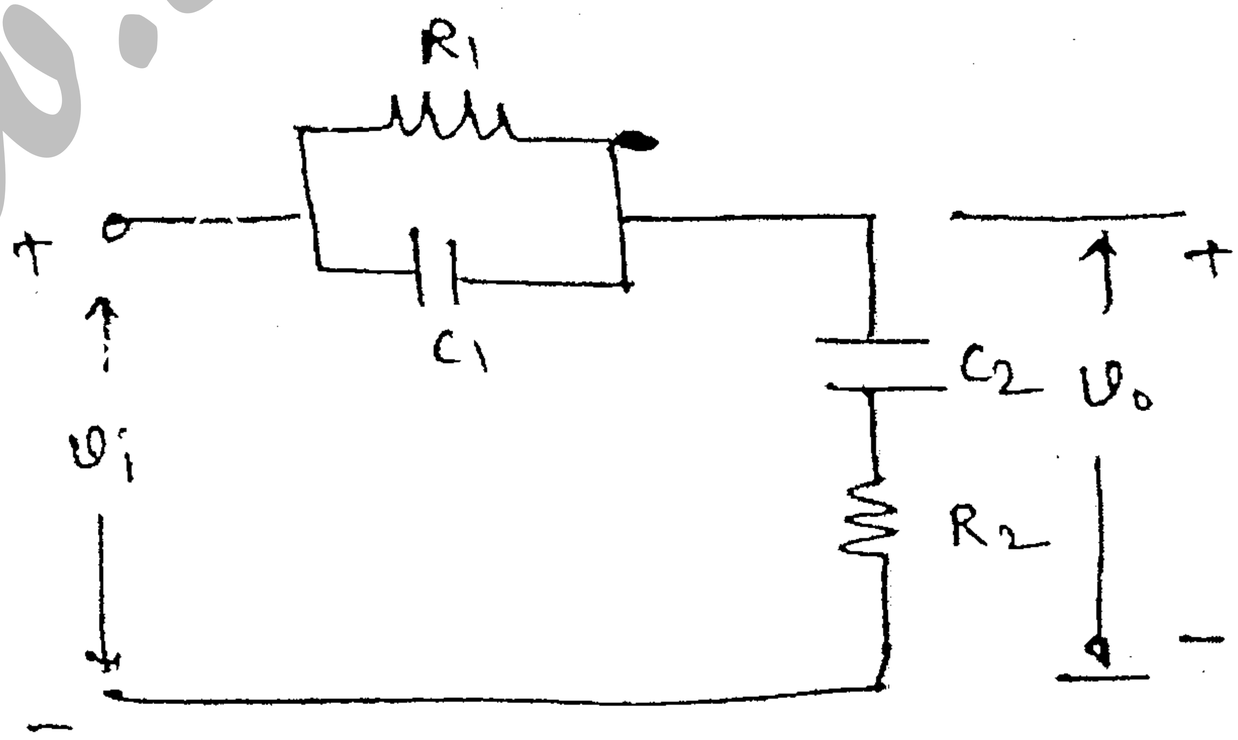
N. B. : (1) Question No. **1** is **compulsory**.
(2) Attempt any **three** questions from **remaining** questions.
(3) **Assume** suitable **data** if **necessary**.

1. (a) Define relative, absolute and robust stability of the system. 20
(b) What is gain and phase margin ? Explain how to find gain and phase margin by using polar plot.
(c) Differentiate open loop and closed loop systems.
(d) What is damping ratio ? Show the location of roots in s-plane for different values of damping ratio.

2. (a) Derive the transfer function of electromechanical system shown in **figure** :- 10



(b) Find the transfer function of the electrical network shown in **figure** :- 10



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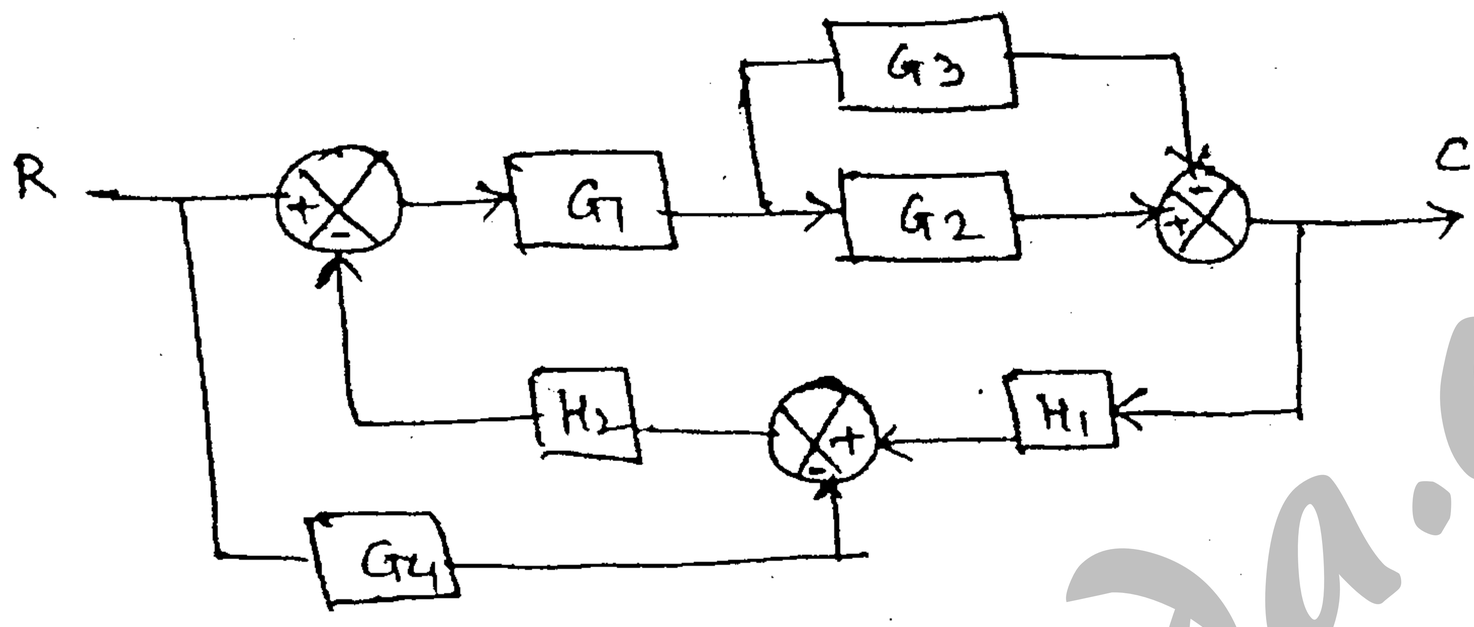
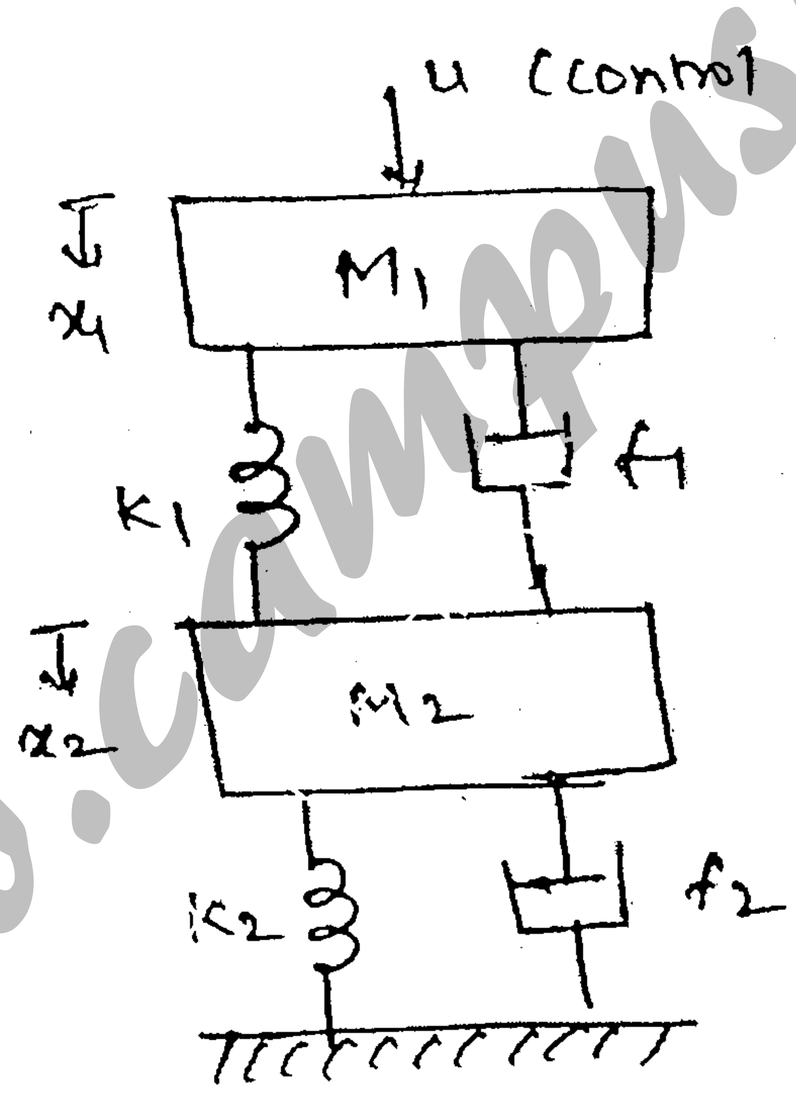
3. (a) Find the closed loop transfer function of the system whose block diagram is given in **figure** :- **10**



(b) State and prove properties of state transition matrix. **5**

(c) What is optimal control ? Why optimal control is needed ? **5**

4. (a) Construct a state model of the system shown in **figure** :- **10**



(b) Predict the controllability and observability for the system :- **10**

$$\dot{x}=\begin{bmatrix} 0 & 1 & 0 \\ 3 & 0 & 2 \\ -12 & -7 & -6 \end{bmatrix}x+\begin{bmatrix} 0 \\ 0 \\ 2 \end{bmatrix}u$$

$$y=\begin{bmatrix} 1 & 2 & 0 \end{bmatrix}x$$

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5. (a) Construct the root locus for the system having following open loop transfer function :- **10**

$$G(s)H(s)=\frac{K}{(s+3)(s+5)(s^2+2s+2)}$$

(b) Construct the bode plot for the following transfer function :- **10**

$$G(s)\cdot H(s)=\frac{10(s+10)}{s(s+2)(s+5)}$$

6. (a) What is adaptive control ? Explain one method of adaptive control. **7**
(b) Explain how the stability of the system can be analysed using Nyquist criterion. **7**
(c) Explain the time domain specifications. **6**
